

## AVIAN CESTODES FROM NEW GUINEA

## II. CESTODES FROM CASUARIFORMES

BY

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*From the Royal Hungarian Veterinary College, Budapest**(Received for publication 5 December, 1922)*

As it has been pointed out in the first part of this paper (Kotlán, 1921), the worms described in both the former and present notes, as well as those which will be described subsequently, belong to a rather large collection of parasites which were partly sent, partly brought back, by the Hungarian naturalist, Lewis Biró, from the formerly German New Guinea, during the years 1897-1899.

The intestinal parasites of birds belonging to the Casuariformes are represented in this collection by numerous Cestodes from *Casuaris picticollis*, Sclat. A hasty examination of these worms showed that they all belong to the family of Davaineidae. On account of external features two species could be distinguished, a larger and a smaller one, both belonging to the genus *Davainea*, R. Bl. (s. l.): Until now only one representative of this genus was known from Casuariformes,\* viz., *D. australis* (Krabbe, 1869), from *Dromaeus novae hollandiae*. This species, however, is easily separated from the two above apparently undescribed forms.

DAVAINEA (s. l.) CASUARII, sp. n.

Host: *Casuaris picticollis*, Sclat.

Locality: Erima and Sattelberg.

The majority of the worms collected from this host—about two hundred more or less developed specimens—belong to this new

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\* Meggitt (1921) quotes in his key to the species of *Davainea* two '*Davainea*, sp. nov., Vevers, 1920' from *Casuaris uniappendiculatus* Blyth. I have been unable to obtain Vevers' paper (*Proc. Zool. Soc.*, 1920.).

species. The strobilae, coming from the two above-mentioned localities, exhibit in their external appearance a well marked difference, for those from Sattelberg are much more contracted and have a shorter, almost cylindrical body, while those from Erima are more stretched and thus longer in size. The largest specimens measure 34 cm., the greatest width (3 mm.) occurs in the posterior part of the strobila. The worms, which are in an expanded condition, bear a well marked scolex, which is short and approximately square, its diameter being 1 to 1.2 mm., while in contracted worms it is not clearly marked off from the strobila. It also happens sometimes that the anterior end of the strobila bears by means of unequal contraction a pseudoscolex-like thickening of 3 to 5 mm. length, with the true scolex at the end, as is shown in fig. 1. The

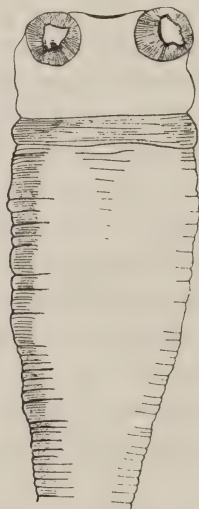


FIG. 1. *Davainea casuarii*, n.sp. Showing the extremely contracted anterior end of the body with the scolex.  $\times 17$ .

rather muscular rostellum measures 0.5 mm. in breadth, and is armed with two hundred and fifty very large hammer-shaped hooks, which are arranged in two rows. The hooks of the anterior row are  $48\mu$  to  $54\mu$ , those of the posterior row  $40\mu$  to  $46\mu$  in length. As far as I am aware, there is only *Houttuynia struthionis* (Houtt.) which has larger hooks, all the other members of the genus *Davainea* (s.l.) bearing smaller ones. In the following table are enumerated some

*Davainea* species the rostellar-hooks of which are comparatively the largest ones and measure over  $20\mu$  in length :—

Species	Host	No.	Length
		of rostellar-hooks	
<i>Houttuynia struthionis</i> * (Houtt.) ... ..	<i>Struthio molybdopbanus camelus</i> ... ..	1641	$65-80\mu^2$
<i>Davainea</i> (s.l.) <i>casuarii</i> , sp.n. ... ..	<i>Casuarium picticollis</i> ... ..	250	$40-54\mu$
„ <i>appendiculata</i> , Fuhrm. ... ..	Unknown ... ..	130	$36-43\mu$
„ <i>infrequens</i> , sp.n. ... ..	<i>Casuarium picticollis</i> ... ..	260	$21-34\mu$
„ <i>fuhrmanni</i> , Southwell ... ..	<i>Crocopus phoenicopterus</i> ... ..	110	$25-30\mu$
<i>Raillietina</i> ( <i>Ransomia</i> ) <i>undulata</i> , Fuhrm. ... ..	<i>Corythacola cristata</i> ... ..	150-200	$25-28\mu$
„ „ <i>campanulata</i> , Fuhrm. ... ..	<i>Perdix</i> sp. ... ..	40-42	$27\mu$
„ „ <i>vaganda</i> (Baylis) ... ..	<i>Haliaeetus vocifer</i> ... ..	numerous	$25\mu$
„ ( <i>Paroniella</i> ) <i>paradisea</i> , Fuhrm. ... ..	<i>Manucodia chalybeata</i> ... ..	about 100 <sup>3</sup> about 200 <sup>4</sup>	$23\mu$ $22\mu$
„ ( <i>Skrjabinia</i> ) <i>oligacantha</i> , Fuhrm. ... ..	<i>Tynamus</i> , sp. <i>Rhynchotus rufescens</i> ... ..	34	$21-23\mu$
<i>Davainea</i> (s.l.) <i>conopopbilca</i> , Johnston ... ..	?	?	23

\* According to Meggitt (1921) *T. struthionis*, as described by different authors, contains more than one species, and reserving the name *Davainea struthionis* for the form firstly mentioned (without proper description) by Houttuyn and described 1885 by Parona, he separates from this latter the following species: *D. linstowi* Meggitt (1921) (= *T. struthionis* of v. Linstow (1893) and Hungerbühler (1910)) and *D. beddardi* Meggitt (1921) (= *D. struthionis* of Zilluf (1912)). The size of the rostellar-hooks is stated to be different in all the three species.

1. According to v. Linstow (1893).
2. According to Fuhrmann (1920).
3. According to Fuhrmann (1909).
4. According to Skrjabin (1914).

The four suckers are rounded in size, and exhibit a well pronounced musculature; they measure  $0.4$  mm. across; their border is covered with very numerous small ( $10\mu$  to  $13\mu$ ) hooks, which are arranged in six to ten rows. A distinct neck occurs only in stretched specimens. The segments, in most of my specimens, are much broader than long. Gravid proglottides are, apart from extremely contracted specimens, almost square.

#### ANATOMY.

As has been mentioned above, the worms are in part greatly contracted, and their aspect is rather thick and compact. Such conditions are to be found usually in worms which possess a well

developed cortical parenchyma, subcuticular layer and cuticle. In *D. casuarii* especially the first is rather wide and exhibits a well marked longitudinal musculature. This latter consists of many more or less distinctly separated bundles of various size. The largest bundles are oval in shape, measuring about  $40\mu$  to  $54\mu$ . They are composed of thirty-five to fifty fibres of various thicknesses. Towards the subcuticular layer smaller bundles are scattered irregularly, consisting of fewer fibres, or even of but a single one. The

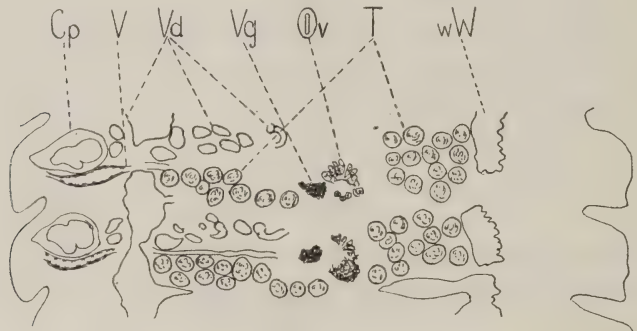


FIG. 2. *Davainea casuarii*, sp.n. Longitudinal section of two mature segments  
Cp.—cirrus pouch; Ov.—ovary; T.—testes; wW.—ventral excretory vessel; V.—vagina;  
Vd.—vas deferens; Vg.—vitelline gland.  $\times 34$ .

transversal musculature separates very distinctly the medullary parenchyma from the cortex. Fine dorso-ventral fibres are present in both parenchyma layers, being especially well marked at the level of the transverse excretory vessel. It is worthy of note that rather large calcareous bodies are scattered in the subcuticula as well as in both parenchyma layers; they are mostly oval in shape,  $10\mu$  to  $16\mu$  in size, and deeply staining with haematoxylin.

*Excretory system.* The excretory system consists in main part of a single pair of very large longitudinal vessels, which are connected at the posterior border of each proglottis by a large transverse canal. Although these longitudinal vessels run justly on the transverse axis of the proglottides, having a diameter nearly equal to the depth of the medullary parenchyma, there is no doubt that they represent the ventral pair of the longitudinal vessels, for in the anterior, mostly immature proglottides, I could undoubtedly distinguish within the two large vessels two narrow, somewhat

dorsally located vessels without transverse commissures. These dorsal vessels disappear apparently in the mature segments. The wall of the excretory vessels is bordered by very minute rounded cells, which seem to be parenchyma cells.

*Genital organs.* The openings of the genital ducts are unilateral, the porus genitalis being situated about the centre of the lateral border of the proglottides. A small atrium genitale is present.

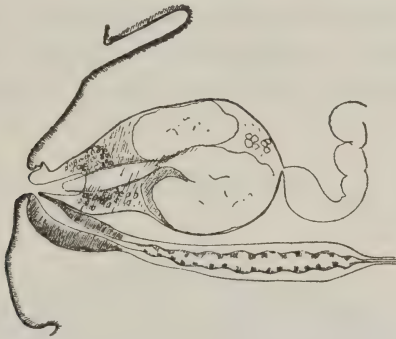


FIG. 3. *Davainea casuarum*, n.sp. Longitudinal section, showing the termination of sex ducts.  $\times 80$ .

*Male organs.* The testes are oval or spherical in shape and  $67\mu$  to  $81\mu$  in diameter. They occupy the whole free space of the medulla at the sides of the female glands. On account of the structure of the vas deferens and vagina, the testes are of course more numerous on the antiporal medulla-half. Their total number amounts to nearly fifty to sixty. In the younger, and also in mature proglottides, the testes exhibit very interesting stages in the development of the spermatozoa. These stages agree in many respects with those described and drawn by Moniez (1881). The vas deferens is a rather wide, coiled tube, the coils of which occupy dorso-ventrally nearly the whole space of the poral medulla-half, displacing ventrally the wide longitudinal excretory vessel just before entering the cirrus pouch. After entering the cirrus pouch, the vas deferens forms a rather large, coiled vesicula seminalis interna, which is usually filled with spermatozooids. The cirrus is short (0.1 mm.); it is surrounded within the cirrus pouch by a dense network of very small cells, representing, perhaps, prostate cells or merely parenchyma cells.

The thick-walled cirrus pouch is pyriform, and measures 0.25 mm. in length by 0.16 mm. in breadth; it does not extend beyond the longitudinal nerve-stem, and thus does not reach at all the longitudinal excretory vessel.

*Female organs.* The position of the vagina, i.e., of the poral portion of the vagina in proportion to the cirrus pouch, varies according to the state of contraction of the strobila. In stretched or normally contracted specimens it lies immediately behind the cirrus pouch; in extremely contracted worms, however, it is sometimes ventral, sometimes dorsal to the cirrus pouch. The poral third of the vagina, extending from the genital atrium just beyond the poral longitudinal excretory vessel, is rather wide, darkly

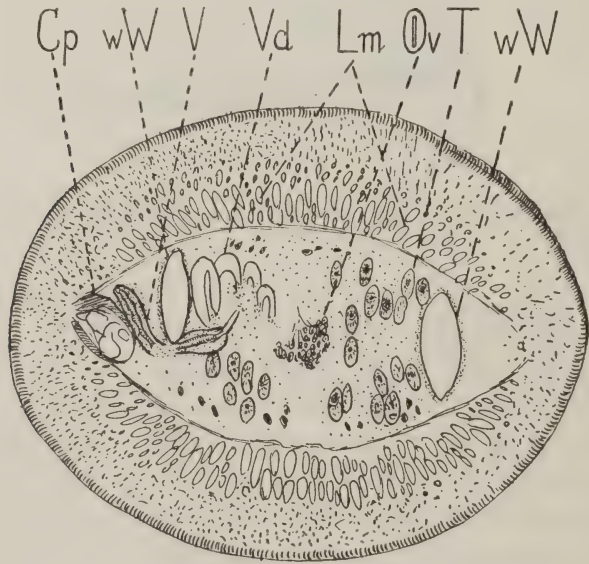


FIG. 4. *Davainea casuarii*, sp.n. Transverse section of a mature segment. Cp.—cirrus pouch; Lm.—longitudinal muscles; Ov.—ovary; T.—testes; wW.—ventral excretory vessel; V.—vagina; Vd.—vas deferens.  $\times 42$ .

staining because of its rather muscular wall and especially on account of the presence on its inner surface of very fine hairs. A similar structure of the vagina is found in other worms, particularly in some members of the family Davaineidae, in the Tetrabothriidae, and also in certain species of the genera *Trichocephaloides*,

*Monopylidium*, *Octopetalum*, etc. Just before the vagina opens into the atrium genitale it bears a distinctly marked sphincter. Within the poral longitudinal excretory vessel the vagina narrows suddenly for a short distance and becomes then nearly as wide again as the vas deferens, forming some coils before reaching the ovary; its course from the longitudinal excretory vessel to the ovary is chiefly ventral, although it passes to the dorsal side of the longitudinal excretory canal, as is usually the case. A distinct receptaculum seminis is absent. The ovary is small; it is situated in the middle of the proglottides lying in longitudinal sections somewhat nearer to the posterior border of the segments and consisting of fine lobes, which radiate in all directions from the oviduct. Its diameter amounts nearly to one-fourth of the breadth



FIG. 5. *Davainea casuarii*, sp.n. Transverse section of a gravid segment.  $\times 34$ .

of the medullary parenchyma. Dorso-ventrally it occupies the entire depth of the medulla, being especially well developed on the antiporal side. The vitelline gland lies quite dorsally in the median part of the medulla, where it appears as a rounded compact organ, measuring about 0.01 by 0.06 mm. A small but distinct shell-gland lies on the main trunk of the oviductus. The uterus appears very early as a rounded sac, which is situated ventrally in the middle part of the medullary parenchyma. While enlarging it becomes apparently

divided into two oval parts, both becoming confluent soon after they reach a larger size. At this stage the eggs segregate into groups of three to four eggs, which latter eventually become egg-capsules; these are mostly oval or rounded in shape; they are bordered by one to two rows of rounded, larger cells, while the two to four eggs (in transverse sections there are visible mostly two, seldom three, eggs in a capsule) are embedded in dense parenchyma containing somewhat smaller cell-elements. The egg-capsules extend beyond the longitudinal excretory vessels, and thus fill the whole parenchyma. About one hundred and eighty capsules can be counted in a transverse section; they measure  $67\mu$  by  $108\mu$  in diameter.

#### *Systematic comparisons.*

As already mentioned above, there has been only one species of the genus *Davainea* hitherto known from birds belonging to the Casuariformes, viz., *Davainea* (s. l.) *australis* (Krabbe). *D. casuarii*, sp. n., differs from this cestode in many respects, but especially in the shape and size of the scolex and the rostellar-hooks. Comparing this new cestode with other members of the genus *Davainea* (s. l.), I find that it agrees in general with the type known in *Davainea*. There is, however, no doubt that it bears some characters which are to a certain degree rare or unusual in this genus; such features are the considerable size of the rostellar-hooks, the absence of one pair of excretory vessels and the well-developed longitudinal musculature. Owing to these peculiarities it seems that there exists a certain relationship between *D. casuarii* and the genus *Porogynia*, Railliet et Henry (= *Polycoelia*, Fuhrm.). The arrangement of the genital glands, however, which in our cestode is of the usual type of *Davainea*, does not allow it to be assigned to *Porogynia*, which latter, moreover, bears three rows of rostellar-hooks on the scolex. On the other hand, it is not possible to place this cestode into one of the genera recently established by Fuhrmann (1920), mainly because of the above-mentioned unusual features. Among all these new genera it is to the large genus *Raillietina*, Fuhrm., sub-genus *Ransomia*, Fuhrm., that our cestode should be assigned, if we do not consider the above-mentioned characters to



be of systematic value, warranting the creation of a new genus or sub-genus for it. For myself, I am inclined to believe that the establishment of a new sub-genus might be justified.

The type specimen is in the Parasitological Museum of the Royal Hungarian Veterinary College, Budapest.

*DAVAINEA* (s.l.) *INFREQUENS*, sp. n.

Host: *Casuarus picticollis*, Sclat.

Locality: Sattelberg.

Only a few specimens of this cestode were found in the same host as *D. casuarii*. The worms are much smaller and narrower than the former species. Unfortunately there were only incomplete individuals available. From two fragments, which belong apparently to one another, one can estimate the total length of the strobila at about 80 mm. by a greatest breadth of 1.2 mm. in the posterior third. The scolex is globular, measuring 0.5 mm. across. It exhibits a fairly well developed rostellum of 0.25 mm. in diameter, bearing a double row of typical hammer-shaped hooks. Their number is about two hundred and sixty. They measure in the anterior row  $27\mu$  to  $34\mu$ , in the posterior row  $21\mu$  to  $25\mu$  in length. The suckers are spherical, their diameter being 0.13 mm. They are bordered by four to six rows of hooks,  $10\mu$  to  $15\mu$  in length. There is a well marked neck measuring about 2 mm. in length. The proglottides are broader than long.

ANATOMY.

The internal anatomy of the worms exhibits the usual characters of the genus *Davainea*; the structures seen in transverse and longitudinal sections were much like those found, especially in some *Davainea* species of Psittaciformes.

*Excretory system.* There is only one pair of large longitudinal vessels, lying usually nearer to the ventral side.

*Musculature.* The longitudinal muscles are well developed; they are composed of an internal layer consisting of about sixty

large oval bundles, and by a distinctly separated external layer, which exhibits two rings of very small bundles consisting of at most two to three fibres. Similar arrangement of the longitudinal musculature occurs also in *D. spiralis*, Baczynska (1914).

Oval calcareous bodies are present, especially in the cortical parenchyma.

*Genital organs.* It seems that the openings of the sex-ducts are unilateral, lying on the left side; in one segment (of about twenty), however, I found the opening on the right. The thick-walled cirrus pouch is 0.18 to 0.2 mm. in length, 0.06 mm. in breadth; it extends to the poral longitudinal excretory vessel. The cirrus is short, rather thick at its anterior end and covered with many spine-like elements. It bears retractor muscles which radiate in all directions to the wall of the cirrus pouch. Within this organ there is an oval vesicula seminalis interna measuring 0.054 mm. in length. The vas deferens forms many large coils in its course towards the middle of the medulla. The testes are about nine to twelve in number, lying not only at both sides of the female glands, but also in the median line of the segments. They measure 0.05 mm. in diameter.

The vagina lies behind the cirrus pouch. Its structure is the same as, e.g., in *D. aruensis*, Fuhrm. (1911) or in *D. allomyodes*, Kotlán (1921). In the middle of the segments, shortly before reaching the ovary, it forms a small spindle-shaped receptaculum seminis. The bilobed ovary, when fully developed, is about 0.2 mm. in breadth; it lies in the middle of the segments. Behind the ovary is situated the compact vitelline gland, which is about 0.08 mm. broad.

Gravid proglottides are not available, and I am, therefore, unable to give a complete description of this worm. The above noted characters are, however, I believe, sufficient to distinguish this form from other members of the genus *Davainea*, of which the following must be considered mostly on account of the similar size of the rostellar-hooks:—*D. fuhrmanni*, Southwell (1922), *Raillietina (Ransomia) undulata*, Fuhrm. (1909), *R. (R.) campanulata*, Fuhrm. (1909), and *R. (R.) vaganda*, Baylis (1919).

The new worm in question seems in every way to be closely related to *D. fuhrmanni*. Comparing, however, the characteristic features of our worm with those of *D. fuhrmanni*, described in

detail by Southwell (1922), I conclude that there are some differences which do not permit the two species to be united. Such are:—

1. The smaller number of the rostellar-hooks in *D. fuhrmanni*.
2. Larger and, in some respects, better preserved material would perhaps show that the genital openings are irregularly alternate in *D. infrequens*.
3. It seems that the cirrus pouch in *D. infrequens* is longer and rather narrower in size.
4. There is no mention in the description of *D. fuhrmanni* of the distinct vesicula seminalis interna.
5. No mention is made of the presence in *D. fuhrmanni* of retractor muscles of the cirrus.
6. The prostate-cells surrounding the coils of the vas deferens are inconspicuous in *D. infrequens*.
7. Finally, it seems improbable that one and the same species of worm should be found in Columbiform and Casuariform birds.

The three other species mentioned above differ from *D. infrequens* in the number of the rostellar-hooks and in other anatomical characters.

The type specimen is in the Parasitological Museum of the Royal Hungarian Veterinary College, Budapest.

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